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AL-MG ISOTOPE SYSTEMATICS IN THE EFREMOVKA E60 CAI: EVIDENCE OF RE-EQUILIBRATION

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Introduction: In recent years, the calcium-aluminum-rich inclusion (CAI) E60 from the Efremovka reduced CV3 chondrite has been used as an age anchor for the Al-Mg extinct chronometer ($t_{1/2}$ ~0.73 Ma) since an internal Al-Mg isochron corresponding to a $^{26}Al/^{27}Al$ ratio of $(4.63 \pm 0.44) \times 10^{-5}$ has been determined for it [1] and a highly precise ^{207}Pb-^{206}Pb age of 4567.11 ± 0.16 Ma has also been reported [2]. However, recent investigations have noted discrepancies between ^{207}Pb-^{206}Pb ages and ^{26}Al-^{26}Mg systematics in several meteoritic materials. For example, Al-Mg systematics in the angrites D'Orbigny and Sahara 99555 anchored to the E60 CAI yield ages that are ~2 Ma younger than the Pb-Pb ages for these achondrites ([3] and references therein). Therefore, with the goal of assessing the suitability of the E60 CAI as a time anchor for the ^{26}Al-^{26}Mg system, we initiated a high-precision laser ablation multicollector inductively coupled plasma mass spectrometer (LA-MC-ICPMS) study of internal ^{26}Al-^{26}Mg isotope systematics in this inclusion. We have previously presented some preliminary results from this investigation [4]. Here, we report the results of further analyses that demonstrate evidence for re-equilibration of the Al-Mg system in E60.

Analytical: A polished thick slice of the Efremovka E60 CAI was studied at UH using a Cameca SX-50 electron microprobe and a JEOL JSM-5900LV SEM equipped with a Thermo Electron energy dispersive spectrometer. Magnesium isotopes were measured with a Thermo-Finnigan Neptune MC-ICPMS instrument and a Photon Machines fast excimer laser ablation system (producing 193 nm wavelength and 4 ns pulse length) at ASU using methods similar to those described earlier [4].

Results and Discussion: Previously we reported analyses of a diopside-rich rim (1 spot), diopside in the interior (2 spots), melilites in the rim and in the interior (3 spots each), and anorthites in the rim (3 spots) of the E60 CAI [4]. Since anorthites in E60 are typically fine-grained and we used beam spots up to ~90 µm, we were unable to get clean analyses of this phase, and the highest $^{27}Al/^{24}Mg$ ratios reported in [4] were only up to ~16. The majority of these preliminary data defined a slope corresponding to a $^{26}Al/^{27}Al$ ratio of $(2.9 \pm 0.5)\times10^{-5}$ and an initial $^{26}Mg/^{24}Mg$ ratio of 0.23 ± 0.09 ‰ (MSWD = 0.9); the exceptions were the melilite rim analyses which fell above this isochron. We have now made additional analyses of interior diopside (2 spots), melilites in the rim and the interior (2 spots each) and anorthites in the rim (4 spots). We used beam spot sizes of ~30–40 µm, and were able to obtain $^{27}Al/^{24}Mg$ ratios up to ~90 for the anorthites. With the exception of the 3 previous melilite rim analyses, all the data taken together define an Al-Mg isochron with a slope corresponding to a $^{26}Al/^{27}Al$ ratio of $(3.20 \pm 0.35)\times10^{-5}$ and an initial $^{26}Mg/^{24}Mg$ ratio of 0.19 ± 0.08 ‰ (MSWD = 1.5). Assuming a canonical initial solar system $^{26}Al/^{27}Al$ ~5×10^{-5}, these data indicate that the Al-Mg system in E60 was re-equilibrated ~0.5 Ma after the beginning of the solar system.

References: [1] Amelin Y. et al. 2002. *Science* 297:1678–1683. [2] Amelin Y. et al. 2006. Abstract #1970, 37th LPSC. [3] Spivak-Birndorf L. et al. 2009. *Geochimica et Cosmochimica Acta,* in press. [4] Wadhwa M. et al. 2009. Abstract #2495, 40th LPSC.

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CHROMIUM FLUENCE MEASUREMENTS IN GENESIS SAMPLES USING A NANOSIMS

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Introduction: Our Sun holds most of the mass of the solar system (99.9%) and its chemical and isotopic composition thus provides the reference standard for astronomical, cosmochemical and geochemical studies. The Genesis mission returned solar wind implanted samples for studying solar wind composition. Previous studies of solar wind Cr fluence in Genesis samples showed over-estimates of it due to surface contamination [1–2]. We analyzed three different Si target samples (60040, 30877 and 60490) by NanoSIMS. With smaller analysis area (10–15 µm² in a 30 µm² rastered area) and meticulous cleaning procedures (sample 60490) [3], the surface contamination of Cr can be avoided. We obtained an average Cr fluence value $3.3 \pm 1.1 \times 10^{10}$atom/cm² ($2\sigma$).

Analytical Methods: We measured positive secondary ions of ^{24}Mg, ^{25}Mg, ^{26}Mg, ^{30}Si, ^{52}Cr, ^{56}Fe and ^{57}Fe simultaneously using a Cameca NanoSIMS 50L ion microprobe at Carnegie Institution of Washington. The 16 keV O^- primary beam was rastered over 30 µm² areas, with signal collection only from the central 10 and 15 µm² region to avoid crater edge effects. The primary beam intensity was around 200pA with a size of 2–3 µm. Each analysis took a little over one hour with 250 measurement cycles. Ratios of $^{52}Cr/^{30}Si$ were averaged in every 5 cycles and summed and the beginning 8 minutes of transient period were not included in the final data. This result was compared with the average results of 3 analyses of a ^{52}Cr implant standard (3×10^{13} atm/cm²) to obtain the solar wind implanted ^{52}Cr fluence. Three different Genesis samples (60040, 30877, and 60490) were measured with a total of 20 analyses. Sample 60490 was carefully cleaned with the hot aqua regia cleaning procedure at the Florida State University [3].

Results: The photospheric Cr/Mg ratio is 0.0126 [4]. Thus, taking the Genesis Mg fluence to be 2.15×10^{12} atom/cm² [5] and considering the terrestrial isotopic abundance of ^{52}Cr (83.8% of total Cr) gives an expected fluence for ^{52}Cr of 2.3×10^{10} atom/cm². We obtain average ^{52}Cr fluences for 60040, 30877, and 60490 of 7.3, 2.8 and 1.3×10^{10} atom/cm², The average fluence of $3.3 \times 10^{10} \pm 1.1$ atom/cm² is in good agreement with the expected fluence and with a previous SIMS measurement [6]. Since, in order to avoid transient sputtering effects, we did not include the beginning 8 minutes of data, we might have under-determined the ^{52}Cr solar fluence especially in the extremely cleaned sample 60490. The somewhat higher value for 60040 is mostly surface contamination. Clearly, obtaining more accurate analyses of the ^{52}Cr fluence requires not only careful cleaning of the sample surface, but also understanding, reduction of the transient effects at the beginning of the data collection and accurate ^{52}Cr implant standards. Mg and Fe isotopic data will be presented at the conference.

References: [1] Wang J. et al. 2007. 70th Meteoritical Society Meeting abstract. [2] Veryovkin I. V. et al. 2009. 40th LPSC. pp. 2422–2423. [3] Huang S. et al. 39th LPSC. pp. 1976–1977. [4] Lodders K. 2003. *The Astrophysical Journal* 591:1120–1247. [5] Jurewicz A. J. G. et al. 2008. 39th LPSC. pp. 2272–2273. [6] Burnett D. S. et al. 2007. 38th LPSC. pp. 1843–1844.